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SEVENTEENTH ANNUAL REPORT

TROPICAL FOREST RESEARCH CENTER

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The year 1956 saw progress in each of the two main lines of research at the Center: forest management and forest products utilization. The major project in forest management research concerned the inauguration of pilot demonstration management in the Luquillo Experimental Forest. In the field of forest products utilization the machining tests of 62 local woods were completed and plans were drawn up for a formal program of research on wood preservation.

Other research projects which were continued from previous years include the studies of artificial forest regeneration in both Puerto Rico and the Virgin Islands, and investigations of tree growth as affected by environmental factors and silvicultural treatment. Some 160 studies of this character were inspected or measured during the year. Of these, 38 were terminated and 27 new studies were begun during the year. The collection of soil trafficability data for the Waterways Experiment Station was completed except for a few remaining weather and soil moisture records.

Directly related to the research work were a number of other accomplishments during the year. The cooperative forestry program was strengthened both in Puerto Rico and in the Virgin Islands. A new cooperative program with the Commonwealth government was inaugurated which provides for a Service Forester to offer direct technical assistance for reforestation of private lands within a concentrated area of critical watershed lands. The Center not only assisted

in the training of the Service Forester but shared under the Clarke-McNary Act with the Commonwealth the costs of planting stock production for this purpose and made 15 demonstration woodlot and roadside plantings outside of the area of concentration.

Another outgrowth of the Center's research work, the program of training foreign students in tropical forestry, was continued during the year. In all, 20 such students from 11 countries spent an aggregate total of 36 man-months at the Center. The main activity of this nature was the spring training course held for 14 students from March 7 to May 18. This course was broad, covering all aspects of forestry. The entire staff participated in the instruction, and cooperative assistance was obtained from the Food and Agriculture Organization of the United Nations and from many local governmental agencies concerned with related problems.

In the Virgin Islands the forestry program carried out in cooperation with the Virgin Islands Corporation succeeded in establishing four forest plantations, three on private lands and one on the Thomas Estate Demonstration Forest. These plantations, including both teak and mahogany, covered about 20 acres.

The proclamation of the 26,000-acre Luquillo Division of the Caribbean National Forest as the Luquillo Experimental Forest led to a study of the resources of this area and the most desirable policies for administering their use. Protection was improved by fencing of critical boundaries and systematized patrol. Numerous tracts adjacent to the forest were located as a part of a land exchange with the Commonwealth which would enlarge the Luquillo Forest in trade for the Toro Negro Forest. This transaction is now primarily a matter for the Commonwealth to complete, purchasing the tracts offered and transferring

title to the Federal Government. Progress was made in the betterment and surfacing of 11.2 miles of roads within the Forest under a contract with the Commonwealth government. Advice was offered to the Commonwealth Parks and Recreation Administration for the betterment of the La Mina Recreational Area within the Forest. The administration of more than 100 permitted special land uses within the forest has continued. Included are some 27 subsistence agricultural parcels where the Center has advised the permittees as regards land use and cropping practices.

The training of the personnel of the Center received more attention in 1956 than in previous years. The Center Leader spent four months of the year in the United States becoming better acquainted with research administration at Washington and at the Southern Forest Experiment Station. The Forest Products Utilization Project Leader attended the annual planning conference of the Forest Products Laboratory at Madison. Staff members attended the spring training course sessions led by outside specialists which were of especial value to them. Particularly important here were the sessions on forest nurseries and planting, interpretation of aerial photographs, and forest policy and administration.

The progress of the Center in 1956 has to a considerable measure been a result of cooperative assistance by other agencies. Assistance received from the Office of the Chief, from the Southern Station, and from the Forest Products Laboratory has made possible a more effective program at the Center both through better administration and through better planned technical work. The Division of Forests, Fisheries, and Wildlife of the Commonwealth continued to make available protected public forest areas and nursery assistance for forest management investigations. The Virgin Islands Corporation financed more than

half of the cost of the research in progress on St. Croix. The Virgin Islands Experiment Station, through provision for office and nursery facilities, was also of material assistance to the work at that location.

FOREST MANAGEMENT RESEARCH

The chief field of investigation at the Center has always been forest management. The Center was handicapped in 1956 because of the vacancy throughout the year of the forest management project leader position and because of the absence of the Center Leader during half of the year. Progress reported here, to a large measure, reflects maintenance work on studies begun previously. Exceptions are the studies of hurricane damage and of regeneration in the Virgin Islands. The most important results of the research are described in detail at the time of publication. Only a few of the highlights are presented here.

Hurricane Damage

The hurricane of August 12, the first to pass directly over the island since 1932, provided also the first opportunity to study extreme wind effects upon improved forest stands and plantations. This hurricane passed over the island, from southeast to northwest, and affected the entire island, but as a hurricane it was not large. Wind records at two locations were 92 and 115 miles per hour. Rainfall was unusually light for a hurricane, generally less than 6 inches for the period of the storm.

A survey of the effects on experiments in progress and on forests in general was undertaken during the weeks immediately following the storm. A report on this survey is in preparation for publication. The general conclusions are the following:

1. Severe hurricane damage to forests, that is, complete or nearly complete blowdown, was limited almost entirely to areas within 5 miles of the path of the storm center. As distance from the path increased the severity of the damage declined sharply.

2. The severity of the hurricane damage to the forests was inconsistent within short distances. Severely damaged stands were found adjacent to unaffected stands of similar composition and structure and in supposedly similar topographic locations.
3. Mixed, all-aged natural stands suffered generally less hurricane damage than plantations.
4. Damage was more severe in thinned than in unthinned stands.
5. Broadleaf mahogany, Swietenia macrophylla King, showed again its susceptibility to windthrow on heavy clay soils, this characteristic having been observed as a result of a storm two years ago.
6. Twenty-year-old eucalyptus (Eucalyptus robusta J. E. Smith) suffered top breakage mostly, while 18-year-old teak (Tectona grandis L.) was uprooted and broken off to almost an equal degree. Both species of ages shown suffered 95 percent or more damage in the direct path of the hurricane.

Only a few of the regeneration and growth experiments of the Center were affected by the hurricane. These were located in the Aguirre, Carite, and Rio Abajo Forests.

Regeneration

The results of the regeneration studies reported here concern primarily the adaptation of tree species to different sites. For this reason they are presented according to these sites, each of which makes up an important area of forest land.

Shallow Loam Soils

Mexican cypress (Cupressus lusitanica Mill) continues to be one of the most spectacular planted trees on rocky shallow loam soils at high elevation.

Observations made in a 6-year-old plantation at 3,500 feet elevation (precipitation 120 inches annually) in the Toro Negro Forest show this species superior even to eucalyptus in growth. Its rapid growth rate plus the potential utility of its wood make this species one of the most promising introductions yet made in Puerto Rico. The trees in this planting average 5 inches d.b.h. and 25 feet in height, with a maximum of 11 inches and 35 feet. Their form is excellent and their dense crowns have shaded out competing vegetation. Naturally established seedlings have begun to appear beneath the plantation. This plantation was not hit by the 1956 hurricane, but the lack of wind-firmness characteristic at low elevation and on deep wet clays is not evident on this rocky site. Additional plantings are proposed for 1957.

Deep Lateritic Clay Soils

Maga (Montezuma speciosissima Sessé & Moc.), an endemic tree species which produces a termite-resistant cabinet wood, has finally been dropped from the research programs, after more than 20 years of efforts to produce it. The tree is not difficult to regenerate, although the seed is very perishable, but other superior species have proven equally adaptable to its sites. Below 1,000 feet elevation, where maga occurs naturally, it is inferior to broadleaf mahogany, Swietenia macrophylla King, both in growth rate and in form. Under these conditions maga typically declines in diameter growth rate after the trees reach 3 or 4 inches d.b.h. At that stage the trees also put forth a large number of sprouts from the stem, and thus lose their initial good form.

Maga on deep lateritic clay soil at 2,500 feet elevation in the Toro Negro forest (precipitation 98 inches annually) has retained its good form. Its diameter growth, while slower than at lower elevation, has been accepted as satisfactory, since no superior species has been known. Now, however, after

20 years, the trees, with an average diameter of 5 inches, and a height of 30 feet, have virtually stopped growing, the crowns have become thin, and many have died from what appears to be a root rot. At the same time adjacent tests of mahoe (Hibiscus tiliaceus L.) have shown this species, which produces a timber of at least equal value, to grow much more rapidly, trees attaining a diameter of 8 inches and a height of 65 feet in 10 years.

The prospects for bamboo production on deep lateritic clays in the mountainous interior of the island have become further clarified by reexamination of a 10-year-old test planting at 3,200 feet elevation (precipitation 110 inches annually) in the Toro Negro Forest. Three species: Bambusa tulda Roxb., B. longispiculata Gamble ex Brandis, and B. textilis McClure were used. The first two are suited for furniture and are outstanding in resistance to powder-post beetles. B. textilis, relatively thin-walled, is useful for baskets and similar articles. Four planting spacings were used, 10 x 10, 15 x 15, 20 x 20, and 25 x 25 feet.

Width of spacing has been significant to date only as regards rapidity of domination of the site by the bamboo. On the more degraded slopes a spacing of 10 to 15 feet is indicated, particularly with the smallest species, B. textilis. With wider spacings weeding was necessary into the third year. On the lower slopes and other more protected sites 25-foot spacing seems adequate for early control of vegetation. Nothing can be concluded yet as to the relative productivity of these different spacings, since intense competition among the plants is only beginning.

At the end of 10 years the B. tulda clumps range from 30 to 45 feet in height and have about 40 culms per clump. B. longispiculata has developed more slowly, averaging 20 to 25 feet in height. On the slopes the plants are chlorotic and still do not dominate competing vegetation. They average about

40 culms per clump. B. textilis ranges from 30 to 35 feet in height and has produced more than 100 culms per clump. Future observations will provide a conclusive comparison between species and spacings in terms of lineal feet of culm per unit of land area.

Additional bamboo tests are proposed for shallow loam soils for possible production of cellulose.

Deep Granitic Loam Soils

Almendrón (Prunus occidentalis Sw.), previously reported as promising as an underplanted tree on deep granitic loam soil at 1,800 feet elevation (precipitation 150 inches annually) in the Luquillo Mountains, has continued to develop very satisfactorily. A 10-year-old underplanting which has been periodically released has produced trees of 2 to 4 inches in diameter and from 20 to 65 feet in height. This species, a native to Puerto Rico, produces a termite-resistant timber prized for cabinetwork. Its development on this site is better than that of other species tested.

Laterite Soils

Mexican cypress (Cupressus lusitanica Mill) shows promise for the reforestation of the laterite soils at an elevation of about 1,500 feet (annual precipitation 110 inches). A 4-year-old test planting in the Maricao forest on a site where many species of eucalyptus have failed has produced vigorous trees 5 to 8 feet tall. The growth rate of these trees is not as rapid as elsewhere in the island, but one favorable result is that the limbs are more rigid and make the trees well suited for Christmas trees. Additional plantings have been recommended for this purpose.

Mycorrhiza inoculation of pines on laterite soil, reported without conclusive results last year, has continued under observation. The species treated was slash pine (P. elliottii Engelm.). The seedlings had already been

outplanted and had become chlorotic. Previous application of calcium superphosphate as a result of soil tests proved unfruitful. The inoculating material was humus and A-horizon soil from shortleaf and longleaf forests in the United States. About 330 cc. of material was worked into the soil around the stem of 23 trees, with 24 alternate trees as checks. After 9 months the treated seedlings had recovered in color of foliage and mycorrhiza were apparent on the roots. The checks were unchanged in appearance, and no mycorrhiza were found. After two years the treated seedlings averaged 2.5 feet in height and continued to show a deep green color, compared with chlorotic check trees, still chlorotic and 1.5 feet in height, about the same size as when planted. It now seems conclusive that the mycorrhiza are a prerequisite to the introduction of slash pine on this area. Additional tests will be made to determine whether the inoculated soil can now serve to inoculate nursery beds and other planted trees.

Rocky Slopes on St. Croix

Experiments directed toward the simplification of regeneration of West Indian mahogany (Swietenia mahagoni Jacq.) and broadleaf mahogany (Swietenia macrophylla King) on the island of St. Croix, begun on a formal basis in 1955, were replicated and expanded in 1956 to include 5 sites, 2 species, 3 seasons, 9 types of planting material, and a total of nearly 12,000 trees or seed spots.

The need to repeat tests for several years has become apparent in the inconsistencies in the results of experiments to date. This is largely due to the variability of the climate, with brief but severe droughts possible any time during the first half of the normally rainy part of the year, from May to September. In favorable years this is the best time to plant because it is followed by three rainy months: October, November, and December, before the normal dry period begins. Planting in these three rainy months is hazardous because the trees may have insufficient time to develop adequately to withstand the subsequent drought.

The most reliable method to regenerate mahogany under these conditions has proven to be the planting of vigorous stock about 18 inches tall with a ball of earth (tar-paper pots). This is as true in the rainy mountains (45 to 60 inches of precipitation) with broadleaf mahogany as it is in the drier coastal hills (25 to 45 inches precipitation) with West Indian mahogany. Accordingly this is the practice generally being followed in the planting program directed by the Research Center for the Virgin Islands Corporation. Nevertheless, costs of planting stock and planting with this method are high, so studies of direct sowing and the planting of bare-rooted stock have been undertaken.

In the humid zone tests have concentrated on broadleaf mahogany, the most rapid growing species. Plantings of bare-rooted stock made in the early fall of 1955 showed that with vigorous planting stock survival can be satisfactory on the best sites. Accordingly, this practice will be used in the forestry program in 1957. Direct seeding of this species on this site is also promising as regards survival. Sowings made during July, August, and September 1956 showed a survival of 80 to 100 percent of the spots (sown 10 seeds to the spot) at the end of the year. The seedlings were vigorous and about 6 inches tall. This method of regeneration, although far cheaper than planting, entails a longer period of plantation care and should not be used generally until its relative economy has been determined. In the meantime the survival of the seedlings through the coming dry season must be determined.

In the drier zone both species have been tested Well developed, potted stock of both species survives planting well in favorable years. Bare-rooted stock has survived well only in especially favorable years and on the more humid sites. Direct seeding in this zone has been generally unsuccessful except where both the site and the weather are especially favorable. The

seedlings, particularly those of West Indian mahogany, remain small and delicate for about a year, requiring special protection. Tests are continuing but present practice in this zone is limited to the use of potted stock, and with broadleaf mahogany only on the more favorable sites.

Silviculture

Natural Forest

Growth measurements made during 1956 in the virgin forest of the Luquillo Mountains have produced additional basic information on tree growth under these conditions. Two extensive forest types were studied, the tabonuco type or rain forest, and the colorado type or montane thicket.

The tabonuco type is found between 600 and 2,000 feet elevation and is subject to 90 to 150 inches of precipitation annually. The forest studied had at the beginning of the period 732 trees of 2 or more inches d.b.h., an average basal area of 204 square feet and a volume of 4,490 cubic feet (including branchwood) per acre.

The colorado type is found between 2,000 and 3,000 feet elevation in this region, in a rainfall zone of 150 to 180 inches annually. The forest studied had an average of 713 trees, 210 square feet of basal area, and 3,503 cubic feet of volume per acre. A summary of individual tree growth of selected species in the two forests appears in Table 1.

The species included in the table produce some of the largest trees of the forest and they are of present or potential value for sawtimber. It is seen that the growth rates, even for dominant trees, are generally very slow, particularly in the colorado type. This is in part a reflection on the heavily stocked condition of these virgin forests. The more rapid growth rate of trees in cutover stands in the tabonuco type has already been reported. In the

colorado type, on the other hand, partial cuttings have not materially accelerated the diameter growth of the remaining trees, so this forest is considered chiefly of protective rather than productive value.

Table 1.—Ten-year diameter growth in the Luquillo Forest

Species	Number of trees and annual diameter growth 1946-56 by 1946 crown classes							
	Dominant		Codominant		Intermediate		Suppressed	
	No.	Growth	No.	Growth	No	Growth	No.	Growth
		Inch		Inch		Inch		Inch
Tabonuco Type Forest								
Dacryodes excelsa Vahl	36	0.07	45	0.08	41	0.10	35	0.08
Buchenavia capitata (Vahl) Eichl.	2	0.32	2	0.29	4	0.10	2	0.01
Cecropia peltata L.	4	0.12	4	0.09	19	0.12	7	0.06
Didymopanax morototoni (Aubl.) Dec. & Planch.	2	0.18	7	0.08	24	0.10	12	0.09
Colorado Type Forest								
Micropholis chrysophylloides Pierre	11	0.09	30	0.08	44	0.09	21	0.03
Calycogonium squamulosum Cogn.	34	0.04	49	0.03	58	0.03	47	0.03
Magnolia splendens Urban	12	0.04	8	0.04	11	0.04	6	0.03
Micropholis garciniaefolia Pierre	79	0.07	74	0.05	79	0.03	39	0.04
Ocotea spathulata Mez.	17	0.02	14	0.04	17	0.01	7	0.004

These data are weak for some species and crown classes because all of these were not well represented in the stands sampled. However, one general relationship which is apparent is the lack of a marked increase in growth rate

with the change from the suppressed to the dominant classes. Between the intermediate and dominant classes, a lesser but still very considerable difference in apparent environment, the growth rates for most species show no increase. This relationship, which is not characteristic of cutover stands, is believed to reflect a decline in vigor in the trees because of their extremely advanced age when they reach codominance or dominance in the virgin forest. An exception is Buchenavia, an emergent species, which apparently is capable of rapid growth to a large size.

The data for Cecropia and Didymopanax are of interest because these species, while little used here at present, have recently attracted attention as a source of light woods suitable for a variety of uses. It is also common knowledge that they are rapid growing components of secondary forests. Their intolerance is borne out by these data which show them to be of slow growth under undisturbed conditions. Regeneration of these species takes place only under openings. It is suggested further here that their rapid growth requires maintenance of low density.

A complete analysis of the 10 years of growth records in these virgin stands is being made for publication.

Plantation Management

Broadleaf mahogany (Swietenia macrophylla King) has produced some of the most spectacular plantations on the island in the sinkholes of the humid limestone forest area. Plantations established in the late 1930's attained by 1950 densities of 80 to 110 square feet of basal area per acre and appeared to be in need of thinnings. Some of the results of experimental thinnings made in quarter-acre plots at that time in a 13-year-old plantation, leaving stands of 70 to 80 square feet of basal area, appear in Table 2.

Table 2.—Mahogany crop tree growth in thinning experiment

Plot	1950 Stand				Periodic annual DBH growth of crop trees	
	Crop trees		Total basal area/Acre			
		Av. DBH	Before thinning	After thinning	1937-1950	1950-1955
	No./Acre	Inches	Sq. Ft.	Sq. Ft.	Inch	Inch
1	112	6.8	110	76	0.52	0.56
2	72	7.3	84		0.56	0.44
3	76	6.3	84	70	0.48	0.54
4	76	5.9	80		0.45	0.52

At the time the thinning was made the stands were regarded as relatively uniform in size and probably beginning to stagnate. The thinning, made largely from below, was intended to eliminate trees of poor form and to make spacing more uniform, as well as to reduce density slightly. The thinning accomplished these objectives.

It was not recognized at the time of the thinning that many of the dominant and codominant trees, subsequently designated as crop trees, were about to put forth exceptional height growth and soon dominate most of their neighbors. Unfortunately height measurements were not taken but these crop trees now stand from 10 to 20 feet above the general canopy level. They are sufficient trees of this character to constitute a full stand in the very near future, and their progress is now the best index of the productivity of the plantations.

Since individual tree growth was not measured in the period immediately preceding 1950 the only measure of prior diameter growth is the mean for the life of the plantation to that time. This mean is probably somewhat higher

than the growth just before 1950 because of increasing density to that time. The tabulation shows, however, that diameter growth following 1950 is, for these crop trees, very satisfactory even where the thinning was not done. This conclusion is valid even though a decline in growth was evident in Plot 2. Furthermore, the increase in diameter growth in the thinned plots is minor.

These plots proved to lack complete comparability, so no mathematical analysis of the results has seemed warranted. However, it is apparent that a light thinning from below in such plantations neither prevents stagnation nor materially accelerates the growth of crop trees. It is chiefly of value in anticipating mortality, as is evident from the fact that 24 trees per acre died in the thinned plots subsequent to thinning (1950-55) as compared with 200 trees per acre in the unthinned plots. Thinnings from below under these conditions can be justified only where products can be disposed of at a profit. Thinnings of dominant and codominant trees of poor form, however, may still be desirable in order that future growth may be put on high quality trees.

Pilot Management

Some 8,000 acres within the Luquillo Experimental Forest were set aside during the year as a pilot demonstration management area. Within this area, which is in addition to that needed for small-scale plot tests, the best known management practices for rain forest, based upon past research, are being applied on a scale adequate to provide a source of raw materials which can be sustained at a level which will attract forest utilization industries and thus strengthen the economic basis for forestry on the island.

Two approaches toward this objective were under way during the year. One, and that of most immediate potentialities, was an attempt to develop economic outlets for trees heretofore considered of little or no value. The machining tests, now completed, have shown the basic suitability of an

increased number of local woods for cabinetwork. The beginnings in wood preservation research, with prospect of help from the Commonwealth for equipment to test pressure treatment, may well lead to closer utilization of roundwood, most of which now has no market. Numerous promising contacts with the Puerto Rico Industrial Development Company suggest the early possibility of manufacturing new products locally from both large and small trees.

The other approach to economic forestry in the Luquillo Forest is through improvement of the timber stand itself. The forest was divided into six working circles and each of these further into compartments. These compartments are being subjected to systematic silvicultural treatment which eliminates trees of no potential value, provides those remaining with adequate growing space, reserves large trees for which a market is likely to be found in the near future, and yet makes available the material cut for today's timber market. During 1956 some 1,076 acres were treated in this manner. At the outset, since the forest has been excessively cut in the past, most of the trees cut are not merchantable, but with the elimination of the worst trees and with the anticipated improvement of industrial utilization of local wood it is believed that in the second cycle a substantial timber sale business will develop.

FOREST UTILIZATION RESEARCH

Research in forest utilization was limited primarily to the determination of wood properties and to wood preservation. In addition efforts were made to apply the results of research to improve local utilization of forest products.

Wood Properties

Tests of machining properties, air seasoning characteristics, and certain related physical properties of 62 local timbers were completed. All material tested locally was graded, and additional material was shipped to the Forest Products Laboratory for tests of turning. The analysis of these tests is now completed and the report is in manuscript form.

The preliminary conclusions from this work, described in last year's report still hold. Many of the woods tested compare favorably with hardwoods which are widely used elsewhere. A preliminary listing of the species into 5 utility classes was made for immediate use in revising the instructions for pilot-demonstration stand improvement work in the Luquillo Experimental Forest. Those instructions now reflect both the silvicultural and utilization characteristics of the tree species of the forest.

Compilation of the known information concerning the properties and uses of 75 timbers of the Caribbean region has also continued and the manuscript is now ready for review. This project is in response to a request from the Timber Trade Conference of the Caribbean Commission.

Wood Preservation

With almost no use of wood preservatives in Puerto Rico at present and with wood products locally in disrepute because of susceptibility to insect attack and decay one of the most promising lines of forest utilization research is the development of practical methods for local wood preservation. Wood

preservation should materially improve the market for the less used timbers and at the same time reduce the demand for fence posts, most of which come from promising young trees in forests already overcut. Furniture must be protected against dry-wood termites and powder-post beetles, and posts and construction timbers must be protected against a host of boring insects, including wet-wood termites and also against decay where exposed to the soil or the weather.

The some 50,000 farms of Puerto Rico use an unknown but tremendous number of fence posts each year. With the average service life of untreated posts not more than 24 months, the replacement of fence posts constitutes not only a continuous heavy drain on scattered privately-owned forests but a growing cost to landowners in terms of the labor required.

The Center has made a few preliminary tests to determine the order of magnitude of treatability of local woods and their service life after treatment. Methods used have been crude but the results have been followed for indications of what might be expected. Examinations of three of these tests were made during the year.

The earliest local test of post preservation, made in 1944, concerns Casuarina equisetifolia Forst posts treated with creosote by the hot-and-cold bath method. The hot bath, at 90°C or higher, was maintained for 7 to 9 hours. Penetration ranged from 2.0 to 2.7 gallons per cubic foot. The treated posts were set in a humid shady area within the rain forest at an elevation of 1,200 feet. The untreated controls all decayed within 4 years, whereas the treated posts are still sound, after 12 years, and with no sign of appreciable deterioration. Posts only butt-treated became unserviceable as rapidly as the untreated posts.

A second test included 33 post species and used the cold-soaking method with a 5 percent pentachlorophenol solution in diesel oil. The length of treatment was 5 days and absorption ranged from 2 to 19 pounds of solution per cubic foot, varying with the species. After 4 years the posts are still sound, although there is some signs of leaching of the preservative on the outer surface of the posts.

A work plan is in preparation for testing hot-and-cold bath treatment using creosote and pentachlorophenol and for the double diffusion method. A pilot plant is being procured for these tests. In addition the Commonwealth government is procuring a pressure treatment pilot plant for the use of the Center in testing this process. The construction of the first commercial pressure treating plant in Puerto Rico during the year, a $100,000 facility with a cylinder length of 42 feet and a daily capacity of 16,000 board feet of lumber, promises to provide another opportunity for research in this field. The plant is now using Wolman salts exclusively, and the owner has offered his cooperation in setting up local tests.

Technical Assistance

The forest utilization research staff, because Puerto Rico has heretofore had little technical assistance in this field, is subject to a large number of requests for advice from importers of wood, sawmillers, retailers, manufacturers of millwork and furniture, industrialists interested in setting up wood using plants in Puerto Rico, and public agencies such as the Puerto Rico Industrial Development Company. Attention to these requests, while not project work in research, is a healthy counterpart of our program. Efforts along these lines are what may be termed as putting research into practice as well as keeping abreast of the local situation. As a result of these contacts

we obtain first-hand information on needed research and on new opportunities for complete utilization of our forest products.

At the request of the Development Company the Center arranged for Dr. James Bethel of the University of North Carolina to make a study of the feasibility of a Federal-Commonwealth cooperative proposal to set up a utilization plant based upon the resources of the Luquillo Experimental Forest. Dr. Bethel's report recommended an experimental plant to include sawmill, dry kiln, post treating facilities, and a charcoal briquetting plant. The Development Company has since been trying to interest outside industrialists to undertake at least part of the proposal for immediate profit rather than for research purposes, using the entire island as a source of raw materials, rather than just the Experimental Forest. Under either approach the research program, as well as forest utilization on the island, is certain to gain materially.

A large importer of tropical woods requested advice from the Center on techniques for seasoning. Methods of piling were suggested, a moisture meter was procured and calibrated, and a brief study was made of the drying of cedro macho, Carapa procera DC. Use of proper piling made possible reduction of moisture content from 45 to 20 percent in 56 days and without drying defects except limited end checking of wide boards.

A number of requests for information concerning the prospects for local charcoal and briquet manufacture have reached the Center through the Development Company. Information has been provided as to the general location and volume of raw materials and samples have been provided for testing. The prospects for a local charcoal industry seem bright because of low labor costs and accessibility to the market of the eastern United States. Charcoal manufacture could also go far to improve the utilization of local forests.

Special interest on developing new uses for local forest products has recently centered around yagrumo hembra, Cecropia peltata L., one of the most common trees of mountain forests, which grow rapidly and yet is almost unused at present. The wood of this species is too weak for the conventional uses of forest products such as construction and furniture and possibly too light for good charcoal. However, for specialty uses such as airplane models, excelsior, chipboard, and pulp products it appears to have considerable promise. Freshly cut wood is not as susceptible to staining or insect attack as most other woods. It seasons relatively rapidly with few defects. A reanalysis of past forest inventories has begun to isolate better information as to the location and volume of this timber available in Puerto Rico. Several industrialists have shown great interest in its possibilities. Furthermore, its adaptability to adverse sites and rapid growth suggest that if a market is developed it may become a popular farm crop for the reforestation of steep lands in private ownership. Reforestation tests will be undertaken next year.

A variety of inquiries have been received concerning other wood products which might be produced locally, such as arrows, particle board, prefabricated houses, boats, pallets, boxes, handles, brushes, and kites. The Development Company has come to use the Center as an important source of basic information for all wood industry inquiries. In most cases Center personnel have an opportunity to talk directly to the industrialists concerned.

A beginning has been made in bringing together a collection of the important wood-destroying fungi of Puerto Rico. Specimens collected are being sent to the appropriate authorities for identification. This information is basic to future attempts to inhibit decay with preservative treatment.